CURRENT SCIENCE

Vol. XII] AUGUST 1943 [No. 8

THE UNITED NATIONS CONFERENCE ON FOOD AND AGRICULTURE

THE Conference sat in Hot Springs, Virginia, U.S.A., from May 18th to June 4th, 1943, and was attended by the delegates of forty-four nations. The Chairman of the delegation from India was Sir Girja Shankar Bajpai, Agent-General for India in the United States; the other members were Sir Pheroze Kharegat, Vice-Chairman, Imperial Council of Agricultural Research, Sir David Meek, Trade Commissioner, London, Mr. H. S. Malik, Trade Commissioner, New York, and the writer of this article.

THE AGENDA

By its terms of reference, the Conference was mainly concerned with post-war problems and with general principles. It was exploratory, fact-finding and technical rather than political. At the outset the objectives of the Conference were not fully understood by the American press and there was a general impression that immediate and urgent food problems arising out of the war were the main subject for discussion. The question of food supplies to meet the needs of occupied countries after their liberation is, however, being dealt with by another United Nations organisation directly concerned with relief. The supply of food under Lease-Lend is also a separate question. The Food Conference was essentially an attempt to consider basic problems of nutrition, food and agriculture in a world freed from aggression and ready to set out once more on the path of progress.

The main items on the agenda were as follows:—

(1) Consumption levels and requirements:
  (a) Food.
  (b) Other essential agricultural products.
(2) Expansion of production and adaptation to consumption needs.
(3) Facilitation and improvement of distribution.
(4) Recommendations for continuing and carrying forward the work of the Conference.

CONSUMPTION

The first task was to study existing consumption levels in various parts of the world and to ascertain how far these conform to a reasonable standard of living. It was from the start recognised that in the great majority of countries the consumption of food is inadequate in the sense that the diets of large sections of the population fall below the standards recommended by nutrition workers. As the Conference Report puts it: "Each country is faced with problems of under-consumption and malnutrition, problems which differ in severity in different regions but which, in general, are everywhere the same." From this conception it follows that any accumulations of unmarketable food products which have occurred in the past were not real "surpluses" in relation to world needs; they were in fact the result of mal-distribution and went hand in hand with gross under-consumption. "There has never been", the Conference declared, "enough food for the health of all people. This is justified neither by ignorance nor by the harshness of nature".

More food, then, is needed, and it can be produced. The Conference made a detailed study of measures for increasing agricultural production and for organising it on a world basis. It considered the relation of national and international economic policies to agricultural problems with special reference to the

distribution of agricultural products. The question of buffer stocks and commodity arrangements to ensure equitable prices and adequate supplies was discussed. It would be impossible, within the scope of this article, to give even a brief resumé of the findings and recommendations on questions of this nature and numerous other subjects of equal importance. Those interested should study the report itself, a document of some 61 pages. Here it is proposed to consider in greater detail the sections of the report which deal specifically with problems of nutrition.

The League of Nations and Nutrition

In this particular sphere the Food Conference was building on foundations already laid by the League of Nations. It will be recalled that the League Assembly in 1935 was impressed by the slogan "Marry health and agriculture". From that year until the outbreak of the war the League carried out valuable work on nutrition on an international scale. The Final Report of the Mixed Committee of the League of Nations on "The Relation of Nutrition to Health, Agriculture and Economic Policy" is an admirable document including many ideas which influenced the United Nations Food Conference. The League's work was, however, largely confined to Europe, North America and the British Dominions. A beginning was made to develop work in the East at the Bandoeng Conference in 1937, but the war intervened before much progress could be made. The Conference had at its disposal the Report "Nutrition in the Colonial Empire", which contains much detailed information about the extent of malnutrition in various parts of the world, notably tropical Africa. Reports on nutrition in China, India, the Netherlands East Indies, the Philippines, Egypt, Mexico and various South American countries were presented by delegates. The Conference was, therefore, in a position to make a wider survey than had been possible to the League. It had plenty of data on which to base its conclusion that "in the world as a whole, the picture is one of world-wide underconsumption, leading to malnutrition and its attendant evils".

Food and Health

Strong statements were made on the subject of nutrition and health. "Malnutrition ... is the close and constant companion of poverty, both national and individual. Poverty almost invariably means a poor and insufficient diet and the latter is the main cause of the disadvantage of the poor in respect of health, so clearly shown by statistics of disease and mortality". It was suggested that the high infant and childhood mortality in many countries, including India, has its roots in malnutrition. Diet deficiency reduces resistance to various kinds of disease, *e.g.*, tuberculosis, and makes convalescence more difficult and prolonged. "There is a close relation between such diseases as hookworm and malaria and malnutrition. In the first place, the economic efficiency of a population in which they are rife is reduced and with it their capacity to produce or purchase an adequate supply of food. Secondly, malnutrition decreases the power of the individual to carry the burden of blood-destroying diseases and impedes his recovery when the burden is decreased or removed by medical treatment. A vicious circle is thus created."

Reference was made to the widespread existence of food deficiency diseases which cause much unnecessary suffering since they are preventable but not prevented. The Conference recommended that a vigorous attack on deficiency diseases should be undertaken. The first step, in many countries, is to ascertain the prevalence of such diseases. The recommendations on this subject are of interest and importance to public health authorities in India.

"On the positive side, there is much evidence of the general improvement of health and physique which can be produced by the improvement of diets and there are also striking examples of the prevention of food deficiency diseases by appropriate measures. Successes already achieved provide abundant hope for the future, but what has already been done is little in comparison with the tasks that lie ahead. ... Good food means good health. It enhances the capacity of human beings to contribute to civilisation and progress and adds to human happiness."

Intermediate Objectives

The goal of "a vastly different world fed in full accordance with the nutritional requirements of its population" is a remote one. Visions of a distant and happy future are pleasing, but they must not obscure our view of immediate reality. Various standards of adequate nutrition have been approved by nutrition workers; these recommend the amounts of nutrients or food constituents necessary to ensure for human beings a high level of health and vitality, in so far as this can be ensured by diet. One of these—that put forward by the National Research Council, U.S.A., in 1943—is quoted in the Conference Report and translated from terms of calories, proteins, vitamins, etc., into foods *per capita* per year. The National Research Council standard means essentially a rich and varied diet containing an abundance of milk, meat, eggs, vegetables and fruits and a relatively low proportion of cereals—it is a standard closely resembling that drawn up in 1936 by the Technical Commission on Nutrition of the League of Nations. Now if such a standard be adopted as the immediate goal in a poor and ill-fed country, the gulf between the standard and the existing level of diet is so great that the value of the standard as a guide to national food, agricultural and economic policy is lost. It becomes necessary, therefore, to set up more easily attainable goals for purposes of practical nutrition work. Recommendations for improvement must be so adjusted as to raise the existing level of diets to a degree which is not beyond the bounds of practical possibility and which, at all events, makes it less remote from the "optimum" standard. "With the continued and expanding application of science to the development of the world's food resources, local intermediate goals can be gradually raised in the direction of the ultimate objective."

The first step, in planning nutritional policies, is to estimate the average consumption of the various foods by the population concerned, preferably on a *per capita* basis. The rough data about food intake so obtained should be checked by family diet surveys. The state of nutrition of the population should be investigated by medical and public health workers. In this way the defects in the national diet will be made manifest. The adjustment of agricultural and economic policy to correct the defects follows. When the existing level of diet is a low one, an "intermediate objective" as defined above must be aimed at. Often the first necessity is *enough* food, without much regard for variety and quality. If, however, enough food can be made available, and there is at the same time some degree of variety, qualitative defects in the diet, *e.g.*, in intake of protein, vitamins, etc., will be very considerably reduced.

Typical Eastern and tropical diets are largely composed of vegetable foods and do not contain milk, meat and eggs except in small or negligible quantities. The increased production of the latter may present a problem of formidable difficulty, but there are other foods such as pulses, leafy vegetables, fish and fruit, which may already be familiar and valuable ingredients in the diet. The production of these should materially and rapidly be increased. Food policy should not run counter to the habits and tastes of the population. There are many condiments and beverages consumed by various peoples which are not in themselves of high nutritive value but which may be of importance in that they increase the attractiveness of monotonous diets. Various traditional methods of preparing food may have more virtue than modern nutrition workers suspect. "Nutritional and agricultural policies which ignore traditional methods of 'enlivening' monotonous diets may defeat their own ends. Such methods should usually be regarded with respect. ... The aim of those whose task it is to secure the improvement of nutrition should be to frame their policies so that they are in tune with and can become part of the social tradition."

The Conference recommended that special attention should be given to improving the diet of "vulnerable" groups, *e.g.*, infants, children, and expectant and nursing mothers. It stressed the importance of education. Various other problems, such as the fraudulent advertising of food preparations and the place of synthetic vitamins in nutrition policy, were also briefly considered.

National Nutrition Organisations

One of the formal recommendations was concerned with the establishment in each country of nutrition committees or organisations which should include authorities on health, nutrition, economics and agriculture, together with administrators and consumers' representatives. In making this recommendation the Conference followed the lead of the League of Nations, which before the war had succeeded in bringing into being national nutrition committees in a number of countries. Some of these did sound and useful work. It was further advocated that the national committees should exchange information and experience and that representatives of the committees should meet regularly "to exchange views and to make proposals for any national and international action necessary to facilitate the progress of their work". It will be one of the tasks of the permanent organisation created by the Conference to arrange such meetings and in general to act as a link between national nutrition committees.

The Immediate Post-War Period

After the war the world will be faced with a general shortage of food, accompanied by and interrelated with shortage of transport, including shipping, and of fertilisers, seeds, agricultural machinery and farming implements. The magnitude of the food shortage will depend on the course of the war and the size of harvests. It is clear that the shortage of animal products will be more serious than that of grain and other vegetable products. In occupied Europe there has been widespread destruction of livestock and it must take some years to restore dairy herds and other food-producing animals. During this period emphasis must be laid on the production of energy-producing foods. This will mean, at any rate, in certain countries, an increase in the acreage under crops for direct human consumption and a delay in the rebuilding of depleted livestock herds—essential though this rebuilding will ultimately be. There must, therefore, be an interval before agriculture can be adjusted so as to ensure the feeding of populations in accordance with the principles of nutrition. During the difficult period of food shortage after the war the necessity of developing long-term agricultural policies designed to raise standards of diet and health must not be overlooked and forgotten.

The Creation of a New International Organisation

One concrete result of the Conference will be the establishment of an international "Food and Agriculture Organisation", which will presumably replace the existing International Institute of Agriculture in Rome, never a very active or successful institution. The new organisation cannot come into being until after the war; meanwhile an "Interim Commission", meeting in Washington, will plan its duties and functions. Sir Girja Shankar Bajpai has been appointed Chairman. The main task of the permanent organisation will be to implement the recommendations of the Conference, some thirty in number. Ultimately the organisation must play a prominent part in directing world policy in the fields of nutrition and agriculture. Its relation to other international organisations (*e.g.*, an international health organisation) which will presumably come into being after the war is a question of great importance requiring careful consideration by the Interim Commission.

Results of the Conference

What exactly did the Food Conference achieve, apart from the creation of a new

international organisation? On the political side, the Conference was of considerable significance. It was the first United Nations Conference dealing with the basic problems of the post-war world. The facts that it was convened by the United States, held on American soil and attended by a delegation from Russia were duly noted by political commentators as indicating the intention of these countries to collaborate with other countries in the international sphere after the war.

The report will be found disappointing by those who expected dramatic results in the shape of trade agreements and commodity arrangements and still more disappointing by those who hoped that immediate steps would be taken at Hot Springs to relieve the present food situation in India. It deals largely with principles and not with the specific problems of any particular country. It is concerned with the future and not with the present. It is in the main a sober and technical document, varying in its subject-matter from dietary standards and deficiency diseases to co-operative movements, agricultural credit and the conservation of water resources. Various aspects of the problem of increasing the production and improving the distribution of food and other commodities were carefully considered and the principles which should guide national and international action were defined. These must carry weight when the war has been won and the opportunity arises for reconstructing world economy on a sound basis. The responsibility of individual governments in raising the nutritional standards of their peoples by following appropriate agricultural and economic policies is stressed throughout the Report. At the same time, there is equally strong emphasis on collective responsibility and international collaboration. Governments which accept the Conference Declaration accept "the obligation to their respective peoples and to one another, henceforth to collaborate in raising levels of nutrition and standards of living of their peoples and to report to one another on the progress achieved".

In the author's opinion, perhaps the main significance of the Conference, apart from the political side, lies in the *attitude of mind* which inspired its deliberations and findings. The extent of poverty and under-consumption throughout the world was fully recognised and the magnitude of the problems to be faced was not minimised. The war has reduced the world's food supply, affected consumption in almost every country, and led to scarcity and famine in countries occupied by the enemy. Nevertheless the whole tone of the report is one of hope in the scientific and orderly development of the world's food resources for the benefit of its population. Scientific research has defined the food requirements of human beings and has shown that most people in the world are under-fed or badly fed. On the other hand, the Report says in effect, the application of science makes abundance of food for all possible, and the economic and political obstacles which impede the enormous potential expansion of production can in the long run be overcome by resolute and concerted action. It is these facts and possibilities which should guide and inspire governmental action, both national and international, and not the political, economic and financial expediencies of the moment. Such ideas are not new; they are familiar enough as the pious reflections of individual writers. What is new is their recognition by a conference of forty-four nations. It is the way that people, and particularly those in authority, *think* about such matters that ultimately decides how the life of the world shall be organised. The battle of the future must be fought out in the realm of thought. It is surely significant that at the first international conference dealing with the world after the war, an essentially scientific approach to the fundamental problem of "freedom from want" was adopted.

In conclusion, some passages from the speech made by President Roosevelt to the delegates after the meeting may be quoted:

"You have been dealing with agriculture, the most basic of all human activities, and with food, the most basic of all human needs. Twice as many people are employed in work on food and agriculture as in work in all other fields combined. And all people have, in the literal sense of the word, a vital interest in food. That a child or adult should get the nourishment necessary for full health is too important a thing to be left to mere chance. You have recognised that society must accept this responsibility. As you stated in your declaration, 'The primary responsibility lies with each nation for seeing that its own people have the food needed for health and life. Steps to this end are for national determination. But each nation can fully achieve its goal only if all work together'. On behalf of the United States I accept this declaration.

"..... You have examined the needs of all countries for food and other agricultural products, both as they will exist in the short-run period of recovery from the devastation of war, and as they will exist over the longer run, when our efforts can be fully devoted to expanding the production of food so that it will be adequate for health the world over. You have surveyed with courage and with realism the magnitude of these problems and have reached unanimous agreement that they can, and must—and will—be solved.

* * *

"..... You have pooled our knowledge of the means of expanding our output, of increasing our agricultural efficiency, and of adjusting agricultural production to consumption needs. In the fields of both production and consumption you have recognized the need for better utilization of the knowledge we now have and for extending still further the boundaries of our knowledge through education and research.

* * *

"... A sound world agricultural programme will depend upon world political security while that security will in turn be greatly strengthened if each country can be assured of the food it needs. Freedom from want and freedom from fear go hand in hand."

W. R. AYKROYD.

August 1943,
Coonoor, S. India.

PROF. J. N. MUKHERJEE, C.B.E., D.Sc., F.R.A.S.B.

WE have great pleasure in announcing that on the occasion of H. M. the King's Birthday this year, Prof. J. N. Mukherjee has been conferred the title of Commander of the British Empire.

Born in Calcutta in 1893, Prof. Mukherjee was educated at the Presidency College, Calcutta, and joined the Calcutta University in 1915 as a Lecturer in Chemistry. He proceeded on deputation to England in 1919 to work in the University of London under Prof. F. G. Donnan, F.R.S., where he made fundamental contributions to colloid chemistry. On returning to Calcutta in 1921, he was appointed Professor of Chemistry in the University. Prof. Mukherjee is well known as the chief exponent of colloid chemistry in India and the work which he has carried out, either alone or with numerous collaborators on the theory of ionic adsorption and his investigations on soil colloids and bentonite suspensions have established his reputation throughout the scientific world as an eminent worker in this field. Prof. Mukherjee was mainly responsible for starting in 1924 the Indian Chemical Society of which he was Honorary Secretary for the first four years. He was elected the President of the Chemical Section of the sixteenth Indian Science Congress held at Madras in 1929. He proceeded to England in 1938 as Leader of the Indian Delegation to the International Conference of Soil Scientists. He is a member of various committees—Imperial Council of Agricultural Research and Central Jute Research Committee—and has taken an active interest in the progress of *Current Science*. In offering our congratulations to him on the recent distinction, we wish him many more years of useful service to science in this country.

DR. S. K. BANERJI, O.B.E., D.Sc.

WE offer our heartiest congratulations to Dr. S. K. Banerji, Superintending Meteorologist, Upper Air Office, New Delhi, on the conferment of the O.B.E. in the latest King's Birthday Honours List. Dr. Banerji has a record of sustained and distinguished scientific work in many branches of Mathematical Physics, Geo-Physics and Meteorology for more than a quarter of a century. After a brilliant career in the Calcutta University, Dr. Banerji worked in the Indian Association for the Cultivation of Science under Sir C. V. Raman and was awarded the D.Sc. degree of the Calcutta University in 1918 for a thesis on "Some problems in diffraction, wave-motion and vibration". He succeeded the late Dr. Ganesh Prasad as the Ghosh Professor of Applied Mathematics. In 1923, Dr. Banerji joined the Indian Meteorological Department as the Director of the Colaba and Alibag Observatories at Bombay. For the next ten years he conducted many fundamental investigations in Seismology, Atmospheric Electricity and Meteorology, contributing several important papers on these subjects. His papers on the Electric Field of thunderstorms and on microseisms associated with storms in Indian Seas are of particular importance. In 1933, Dr. Banerji was transferred to the Headquarters Office at Poona where, in the midst of heavy administrative duties he found time to continue his scientific work. He officiated as Director-General of Observatories several times and was appointed as a Superintending Meteorologist in 1938. He had a large share in bringing about much of the recent expansion and development in the meteorological development. Last year, Dr. Banerji took up the duties of Superintending Meteorologist of the Upper Air Office, New Delhi, in charge of the Upper Air Organisation of the department. We offer our warmest felicitations to Dr. Banerji on his honour and wish him many more years of distinguished service to the cause of science in India.

BRITISH UNIVERSITY PROFESSORS

READERS of *Current Science* will be greatly interested to learn of two important appointments recently made in British Universities. Prof. A. C. Chibnall of the Imperial College, London, succeeds Sir Frederick Gowland Hopkins as Professor of Biochemistry in the University of Cambridge. Prof. Chibnall was chiefly concerned in his earlier work with lipoid constituents of plants. Later, he devoted more attention to proteins and other nitrogenous constituents of plants in relation to problems of nitrogen metabolism. More recently he is interesting himself in fundamental problems of protein structure to which he has made important contributions.

In the University College of North Wales, Bangor, on the retirement of Professor J. L. Simonsen, Dr. Edward David Hughes succeeds him. Dr. Hughes is noted for his work on the ionization (or "heterolysis") as controlling phase in a large class of substitution and elimination reactions of saturated molecules and ions, the discovery of the rules governing the spatial orientation of substitution (including a demonstration, by the use of radio-halogens, of the invariability of Walden inversion in bimolecular substitution), and the elucidation of circumstances which control the appearance of steric hindrance in substitution processes.—*Nature*, 1943, 151, 610.

THE NEW Rh CONSTITUENT OF HUMAN BLOOD

BY

S. D. S. GREVAL

(Imperial Serologist's Laboratory, School of Tropical Medicine, Calcutta)

(For blood groups see this *Journal*, 1940, **9**, No. 11. In the present communication technical terms are explained in square brackets when not explained in the text.)

What It Is

RECENT work in America has brought to light yet another constituent (in addition to A & B, and M & N) of the human red blood cells, hereafter called r.b.c.: it is the Rh substance (immunologically the *antigen*, genetically the *character* and loosely, unfortunately, the *factor*). It is called Rh because it occurs normally in the r.b.c. of *Macacus rhesus* [the common brown monkey of India]. It has also been found in America in about 85 per cent. of the human beings tested.

How Human Beings are Tested

Rhesus monkey's washed r.b.c. are injected into a rabbit or guinea-pig. After a suitable course of injections the *serum* [the watery part of the clotted blood] of the animal begins to *agglutinate* [clump] the monkey's r.b.c. when brought into contact with them in a test tube or on a slide. When the action is strong the r.b.c. are *lysed* [broken up]. This is brought about by an anti-Rh hæmagglutinin [a substance clumping r.b.c.: such anti-substances formed as a result of injections are called *antibodies* in a general way: when the r.b.c. are lysed the substance is *lysin*: the animal has been *immunised* against the monkey's r.b.c.]. The serum, in suitable dilutions, also agglutinates the r.b.c. of 85 per cent. of human beings. These human beings are Rh+: the other 15 per cent. are Rh−.

Importance in Medicine

An Rh+ father's child conceived by an Rh− mother may come to grief. The fœtus [developing child in the womb] has in his veins his father's blood which acts on the mother as the injected blood acts on the animal. The mother is *iso-immunised* [*iso* because of the same species] and the anti-bodies act deleteriously on the blood of the fœtus causing its death and expulsion or such a damage to its r.b.c. that on birth the child suffers from jaundice and anæmia and more often than not dies.

Ordinarily the fœtal r.b.c. and the maternal r.b.c. do not mix: a membrane keeps them apart. The membrane, apparently, at times leaks. The antibodies in the mother's blood, on the other hand, being in solution pass freely into the fœtal blood at all times.

Fortunately all Rh− mothers of Rh+ fœtuses do not act in this infanticidal manner, at least not in the first pregnancy. The reason is constitutional. Either the leak in the membrane separating the two circulations does not develop or their systems do not react with full vigour.

Further, not all Rh+ fathers beget Rh+ children from Rh− mothers. The reason is genetical. The character Rh(= Rh+) is dominant to the character rh(= Rh−). A homozygous father (genotype RhRh) must beget Rh+ children while a heterozygous father (genotype Rhrh) may or may not.

It may be asked why a fœtus whose blood group is incompatible with his mother's does not suffer the same fate for similar reasons. The fœtus A of a mother B will also *iso*-immunise the mother who will discharge into the fœtal circulation antibodies against the substance A. The reason so far available is that the group specific substances A and B occur well distributed throughout tissues and fluids of the body, while the Rh substance occurs only in the r.b.c. which, thus, are exposed to the full effect of the mother's antibodies.

The Rh− mother having formed in her blood the antibody against Rh+ blood also comes to grief when she is given a transfusion of an otherwise compatible but Rh+ blood. This risk makes the direct matching of the bloods of the donor and the recipient doubly important when the recipient is an expectant mother or a mother in or after labour.

Human Blood is also Used in Testing Human Beings

When it is known that a mother has given birth to a baby which is suffering from damage to its r.b.c., the mother's blood is taken and serum obtained from it. This serum will also agglutinate the r.b.c. of Rh+ human beings. Not all such sera are satisfactory. The subject is being studied and points to a rather complex structure of the Rh antigen.

Importance in Sociology

A well-known worker on the subject has already suggested artificial insemination, from extraneous compatible sources, of Rh− females incompatibly mated with Rh+ males. A consideration of compatibility before marriage is more natural and will probably be demanded. Most people would be compatible. Others could wait for compatible partners.

Importance in Forensic Medicine

When the technique of the test has been standardised and further observations on the inheritance of the character Rh made, one more aid to the determination of paternity and maternity of children will be provided. Going by what has been said above of an Rh+ father, some Rh+ couples (genotype Rhrh) can have a Rh− child but Rh− couples cannot have a Rh+ child.

Importance in Anthropology

The serologists have given to the anthropologists yet another means of differentiating between races of humanity.

Levine, P., *New York State Journal of Medicine*, **1942**, **42**, No. 20, 1928. 2. Boorman, K. E., Dodd, B. E., and Mollison, P. L., *British Medical Journal*, November **1942**, **7**, p. 535. 3. Gallagher, F. W., and Jones, L. R., *The Journal of Immunology*, **1943**, **46**, No. 1, 9.

THE RÔLE OF PREDATORS IN BIOLOGICAL CONTROL OF INSECT PESTS

By Dr. K. N. TREHAN
(Professor of Entomology, College of Agriculture, Poona)

Introductory

UNDER favourable conditions of food and climate, insects multiply freely but their population is regulated automatically by the presence of their enemies or through the intrinsic limitations of the organisms themselves (Thompson, 1939). This view is also supported by Elton (1930) who emphasized that animal population is controlled by natural factors to a position of optimum density. Occasionally, however, some pests attain prominence either when they are transferred to new environments where they flourish unchecked in the absence of enemies, or in their original habitat where they establish relatively more harmonious relations with their surroundings. Under such circumstances, the economic loss is apt to increase in geometrical progression unless a speedy control is adopted. Insecticidal and mechanical methods of control are practicable when speedy control is desired, but their repeated applications always increase the cost of production since a single treatment does not ensure the crop against future attacks. Cultural methods of control have practically limited scope since they involve certain complications with respect to different varieties, date of sowing, number of irrigations and manures, etc. Biological control on the other hand, implies the application of parasites or predators, either introduced from their original home or bred artificially and liberated in the fields. Both these types of beneficial insects flourish in nature in association with the pest which is thereby kept under control. The parasites cause the death of their victims through a slow process, whereas predators destroy them directly by feeding on them. A lot of useful literature on parasites and parasitism is available but the predators on the contrary have received relatively little attention even though their efficacy has been experimentally established in certain cases.

Origin of Predators

Insects are believed to be primarily phytophagous. In nature, therefore, some species of insects must of necessity have been established on one and the same food plant. Hence according to Sweetman (1936) a slight variation in food habits may produce a useful predatory species. Under extreme cases of restricted food however, a keen competition among individuals of one and the same species or of different species is bound to occur and some of the individuals may be forced to develop cannibalistic habits. Such deviations in feeding habits probably resulted in modification of certain useful characters which in the course of further development became functional and permanent. In most cases, however, morphological modifications are confined to the mouth parts and the grasping organs only.

Secondary differentiation in habits is met with among *Syrphid* larvæ which may be phytophagous, carnivorous or sepprophagous. Similar differentiation is also noticed among *Coccinellidæ*, with characteristic modifications in the mandibles of carnivorous and herbivorous forms. It may, therefore, be believed that the predatory habit among insects is secondary in origin.

Host-Predator Relationship

The activities of parasites are usually more appreciated than those of the predators whose specificity in the selection of hosts is often doubted. However, Thompson (1928-29) examined this factor critically and emphasized that the predators like the parasites, are equally specific in the choice of their hosts. For instance, *Hyperaspini* is said to feed exclusively on coccids; *Hippodemiini* mostly on aphids and *Microweiscini* destroy *Diaspini* scales. The genera *Rodalia* and *Novius* feed on Icerya whereas *Scymnus*, *Syrphids* and *Chrysopids* prey upon aphids and white-flies. Some of the Carabids feed mainly on larger *Lepidoptera* and the *Nitidulid-Rhizophagus* feeds on wood-boring coleopterous larvæ. Of the Hemiptera, *Perillus bioculatus* confines its attack on colorado beetle—*Leptinotersa decemlineata* Say. According to Morris (1938) *Eupelmella vesicularis* Retz. confines itself exclusively to *Microplactron fuscipennis* Zett. as a host and is capable of detecting the presence of its larvæ and pupæ even within the cocoons of the Saw-fly.

The primary relation between the host and the predator is their close proximity. As a rule, both these types flourish in one and the same environment; the surroundings agreeable to one may be presumed suitable to the other, both establishing for themselves an ecological equilibrium. Food being the primary consideration, increase in pest population is normally followed by the corresponding increase in the numbers of its enemies. This statement has a bearing on the laws concerning the interaction of a predator and its prey, *vide* Volterra (1926), since it is concluded that, if the prey is given additional protection the mean values of the populations of both the species, increase. Nevertheless, a keen competition between the two rival factors ensues but usually the activities of the predacious insect predominate and ultimately it becomes a controlling factor, the effect being reproduced automatically. Since a predator multiplies at the expense of the host, the predators will also be affected adversely to some extent.

The greatest achievement, however, is brought about by the fact that predators as a rule, kill far too many individuals than are actually required as food. Thus the performance of a predator differs remarkably from that of a parasite which can kill only one host at a time. Often even this much is far from expectation, since a parasite may deposit more than one egg in one and the same host or if it be a case of superparasitism two or more species of parasites may contribute simultaneously towards the ultimate death of a single host. The capabilities of a predator, on the contrary, are well pronounced and this fact predominates even if a predator is relatively

less prolific or less specific. Clausen (1916) estimated that *Hippodamia convergens* Guer. destroys on an average, 21 aphids a day during its larval stage and the number consumed by the insects of any single species during one life-cycle may go upto 624. Wildermuth (1916) observed that *Chrysopa californica* is capable of destroying 300-400 aphids during its larval life, while according to Simenton (1916) a single larva of *Hyperaspis binotata* Say. may destroy 90 adults and 3.000 coccid larvæ during the entire larval period. Burgess (1911) estimated that on an average, a single larva of *Calosoma sycophanta* L. devours 41 full-grown caterpillars of gipsy moth and the adult may kill 238-272 caterpillars during its life. Certain coccinellids, however, have been observed by various workers to destroy upto 1,000 caterpillars. Morris (1938) states that one larva of *Eupelmella* is capable of eating 20 larvæ and pupæ of *Microplectron* and finally it kills all the remaining living young ones of the host before it pupates. Similar observations support the importance of various species of predators in the control of the pest.

This fact is further strengthened by the observation that in most cases both the adults as well as the larvæ possess predacious habits; their activities, therefore, prove all the more effective in the destruction of pests. This behaviour may even compensate for the slightly lower rate of reproduction although this feature is not of common occurrence. On the contrary, some predators as in Meloidæ are rather prolific and may lay from 2,000–10,000 eggs per female.

Hyper-Predatorism

Some of the useful predators assume the status of injurious insects as a result of which their utility is greatly handicapped since they prey upon other predators. This behaviour is allied to hyper-parasitism and as such works adversely in the control of insect pests. Henson (1937) gives a few instances of this nature and particularly mentions *Thanasimus formicarius*, a predator on bark-beetle. This predator is extremely voracious both in its adult and larval stages but unfortunately it destroys equally readily the larvæ of Rhizophagus and *Euraca* spp., both of which are quite effective predators on the same pest. Their cannibalistic habit may even be extended further when they begin to devour each other in the absence of any food. This undesirable activity interferes materially with the biological control of the pest.

An interesting instance of similar nature to that described above is cited by Morris (1938) where a chalcid *Eupelmella vesicularis* Retz. acts as a predator on another chalcid parasite, *Microplectron fuscipennis* Zett. and on saw-fly, *Diprion sertifer*, in Hungary. It has been observed that once this predator gets established, it definitely brings about an appreciable inhibitory effect upon the efficiency of the primary parasite in the control of the pest.

Such instances of hyper-predatorism or of predators on primary parasites are practically unrecorded in India. However, systematic observations will be needed before we are in a position to confirm its existence in our country.

Application of Predators

Introduction of useful insects has actually yielded results of considerable importance and as in the case of parasites the utility of some of the predators has equally been tried by various investigators in other countries. For instance, *Novius cardinalis* (Imms, 1926) Syn. *Vedalia cardinalis* (Wardle, 1929) proved its efficacy in the control of Fluted scale *Icerya purchasi* of citrus in Hawaii. Similarly *Cyrtorhinus mundulus* (Wardle, *Cytorhinus mundulus*) effected a complete control against *Perkinsiella sacoharicida*, a very serious pest of sugarcane in Hawaii. *Calosoma sycophanta* L. was regarded one of the most important biological factors of control against the gypsy moth in New England. Results of considerable encouragement have also been obtained by the introduction of *Hyperaspis silvestrii* in Hawaii from Mexico, since it completely controlled the Avocordo Mealy-bug, *Pseudococcus nipæ*. Another instance of a perfect control by a predator was through the activity of a coccinellid beetle, *Cœlophora inacqualis* against a black aphid. A similar enterprise of outstanding nature was the control of *Citrophilus* Mealy-bug in California with the help of *Cryptolœmus* lady-bird beetle. In India, similar enterprises have not received much response. Recently, however, Rahman (1940) has contributed a valuable list of the important predators in India and added brief notes on their life-history and seasonal activities.

Husain and Trehan (1933) state that the adults of *B. gossypiperda* (*B. tabacci*), the white-fly of cotton in the Punjab, killed by the larvæ of *Chrysopa* sp. and *Brumus* sp., far exceed that which is actually required for food. Their population in the fields yielded the following results and their application in field cages practically controlled the pest:—

Table I

Date	*Brumus* sp. per 100 plants		*Chrysopa* sp. per 100 plants	
	Adults	Grubs	Adults	Grubs
31- 8-29	52	212	396	1,084
5- 9-29	348	404	321	1,632
24- 9-29	—	—	—	380
3-10-29	128	—	108	240
13-10-29	104	48	60	52
20-10-29	—	95	—	56
1-11-29	—	—	60	—

Rahman (1940) also pointed out that various species of *Aleurodidæ* in the Kulu valley are kept under control through the activities of *Brumus suturalis* and *Scymnus* sp. *Eriosoma lengigerum* (woolly aphis) has quite a number of insect enemies in the Kulu valley. Its relative decrease in numbers during certain parts of the year is generally attributed to the prominence of certain predators, the commonest being *Ballia encharsis*, *Syrphus confrator*, *C. chrysopa* sp., and *Chilomenes bijugus*.

Ayyar (1940) recorded a new species *Scymnus coccivora* which has been regarded as an extremely effective natural control against the *nim* scale, *Pulvinaria maxima*, round about Coimbatore. Kapoor (1939) contributed a short note on the bionomics of *Adonia variegata* Goez., and stated that its larvæ are capable of feeding on 65 aphids during various instars. The adults, on the other hand, may feed on 35-75 aphids per day.

QUALIFICATIONS OF AN EFFECTIVE PREDATOR

Significance of biological control goes with the accurate functioning of the predators utilized for the purpose. A few primary qualifications, therefore, may be considered necessary before a final selection is made.

1. Specificity for a given host is extremely essential since a predator's efficacy depends considerably on this behaviour. A thorough study, therefore, is needed and the range of hosts studied properly. A predator showing the greatest tendency to feed on the pest under consideration should be encouraged.

2. Rate of reproduction and the capacity of preying upon the pest need special attention. A predator which multiplies rapidly and at the same time its individuals are in the habit of destroying too many insects, will prove extremely successful in controlling the pest.

3. Seasonal activity of the predator should coincide with that of the pest. Greater achievements may even be expected if a predator assumes activity slightly earlier than the pest. This will surely facilitate the control because of the superiority of the predators over the pest with respect to their numbers.

4. A predator will achieve maximum efficacy if its multiplication is not checked in any way, by its parasites or predators.

Thanks are due to Dr. Khan A. Rahman, Lyallpur, for valuable suggestions.

1. Afzal Husain, M., and Trehan, K. N., *Ind. J. Agric. Sci.*, 1933, **3**, 701–53. 2. Burgess, A. F., *Bur. Ent.*, 1911, **B 101**, 1–94 (*vide* Sweetman). 3. Clausen, C. P., *Univ. Calif. Pubs. Ent.*, 1916, **1**, 251–99 (*vide* Sweetman). 4. Elton, C. H., *Animal Ecology and Evolution*, 1930. 5. Henson, H. S., *Bul. Ent. Res.*, 1937, **28** (2). 185–236. 6. Imms, A. D., *Text-Book of Entomology*, 1934. 7. Iyyar, T. V. R., *Hand-Book of Economic Entomology for South India*, 1940. 8. Kapoor, A. P., *Proc. 26th. Ind. Science Congress, Lahore*, 1939, **3**, *Abstracts*, 146. 9. Morris, K. R. S., *Parasitology*, 1938, **30** (1), 20–32. 10. Rahman, K. A., *Proc. Ind. Acad. Sci.*, 1940, **12**, 67–74. 11. Simenton, F. L., *Jour. Agr. Res.*, 1916, **6**, 197–204 (*vide* Sweetman). 12. Sweetman, H. L., *The Biological Control of Insects, Ithaca, New York*, 1936. 13. Thompson, W. R., *Bul. Ent. Res.*, 1928–29, 19, —; *Parasitology*, 1939, **31** (3), 299–388. 14. Volterra, V., *Mem. Acad. Lincei, Ser.*, 1926, **6, 2**, 37, 31–113 (Reference). 15. Wardle, R. A., *The Problems of Applied Entomology*. McGraw-Hill Book Co., New York, 1929. 16. Wildermuth, *Text-Book of Entomology*, Imms, 1916 (Reference).

SOME ASPECTS OF SHARK LIVER OIL INDUSTRY IN INDIA

BY DR. C. C. JOHN

(Department of Marine Biology and Fisheries, Travancore)

IT is now more than three years since the manufacture of Shark Liver Oil was started on a commercial scale in India and within this short period, it has gained considerable popularity as a substitute for Cod Liver Oil. The industry was first started under the initiative of the Fisheries Departments of Travancore and Madras, but soon other maritime provinces followed the example and in due course, private enterprises also started manufacture. At present, though all these concerns are exploring every possible avenue for increasing production and though the output to-day is much greater than what it was two years ago, it can be safely asserted that, at present, the demand is much in excess of available supplies.

It is a generally accepted fact that dislocation of International trade due to conditions of war, provides opportunities for developing indigenous industries. This is well exemplified by the growth of Shark Liver Oil industry in India. Though Shark Liver Oil was known to possess high vitamin potency it was never able to find a market in competition with Norwegian Cod Liver Oil during pre-war days. But, when the supply of Cod Liver Oil was completely cut off and when the medical profession began searching for a suitable substitute, the valuable researches and propaganda conducted by the Nutrition Research Laboratory at Coonoor, assured confidence regarding the suitability of Shark Liver Oil and very soon this new product found a place on every chemist's counter in many parts of India. But this meteoric development had its disadvantages. In the midst of heavy rush of orders and efforts to increase production there was hardly any breathing space to realise the necessity for improving methods of manufacture, based on correct principles of fish oil technology. If, however, this tendency to ignore the necessity of improving quality is allowed to prevail unchecked, it may ultimately prove disastrous to the future of the industry and once more yield to the influx of foreign products when conditions return to normal. Stabilisation of the industry will be possible only if side by side with every effort to increase production, equal, if not greater, attention is concentrated on improving and standardising quality through scientific investigations.

Researches on fish oils so far undertaken in India relate to the determination of vitamin A potency and the specific chemical properties of the oils of some of the common varieties of sharks found in Indian seas. On the manufacturing side, however, no work of any importance seems to have been carried out nor any endeavour made to adopt the technical principles followed elsewhere. The disadvantages resulting from the neglect of this aspect may be summarised as follows:—

Fish oils tend to become rancid when stored for more than a limited period of time. Peroxides formed during the process, cause rapid destruction of vitamin A. If, therefore, the vitamin is to be preserved, oxidative rancidity should be prevented. The method of extraction, storage, influence of light and the degree of unsaturation, are all important factors which control the development of peroxides. In foreign countries antioxidants derived from certain seeds are used for the stabilization of fish oils but this is mostly kept as a closely guarded trade secret. It is necessary to prepare extracts of the indigenous seeds and test them so as to discover a suitable antioxidant.

The removal of sterine from Shark Liver Oil is an important process which determines the quality of oil for human consumption. At present raw oil is cooled at random. But

since a suitable method has not been developed the precipitated sterine is not always in a form in which it can be easily filtered. It has been found that the crystallisation of sterine is very sensitive to changes in the rate of cooling and so the most economical and efficient method of sterine separation will depend on the determination of the rate of cooling for oils extracted from the livers of various types of sharks. The prevention of sterine formation in cleared oils by means of protective colloids is also an important problem.

Vitamin A potency of Shark Liver Oil is the chief factor which determines the value of the oil. It is, therefore, worthwhile to enquire how far this property is safeguarded under the prevailing systems of uncontrolled and emperical methods of manufacture. There are a number of brands of Shark Liver Oil now in the market and in the majority of cases the vitamin values are not specified. Almost all of them maintain that their vitamin potency is more than double that of ordinary Norwegian Cod Liver Oil. However, it may be pointed out that the latter is not known to contain more than 500 International Units of vitamin A per gramme whereas the average vitamin content of Shark Liver Oil is 10,000-12,000 International Units per gramme. Therefore, the statement that Shark Liver Oil contains double the vitamin content of ordinary Cod Liver Oil would imply that four or five volumes of some vegetable oil has been mixed with each volume of pure Shark Liver Oil. This process is called blending and though the ostensible aim is to standardise the finished product, the method followed is not quite satisfactory. If blending is designed to bring the vitamin content to a constant proportion, the vitamin value of each sample of Shark Liver Oil should be determined and on that basis the quanity of groundnut oil to be added must be calculated. In other words, specific and seasonal variations in the vitamin content of Shark Liver Oil should form the basis for calculating the proportion of blending. But is blending after all, indispensable? The vitamin content of halibut liver oil, for example, is many times higher than that of Shark Liver Oil and, if the principle of blending is accepted as a general rule, it would imply that halibut liver oil should also be blended in a similar manner. In actual practice, however, this is not done. The properties of the oil are conserved in tact, while the dosage is reduced in an inverse ratio, so that in cases where a few ounces of ordinary Cod Liver Oil is necessary, a few drops of halibut liver oil will suffice. If, therefore, it is feared that the vitamin concentration of Shark Liver Oil is high, all that is necessary is to specify the actual values so that physicians may regulate dosage according to requirements of individual patients. This will eliminate the necessity of blending and conserve the original properties of the oil unaltered.

In the methods of manufacture also there are certain inherent handicaps which contrast Indian conditions with those of other countries. For example, in America, during the halibut fishing seasons, fleets of fishing vessels go out into the Atlantic and the livers collected are at first frozen or steamed before being shipped to the coast, where entire lots are sold to one or other of the big manufacturing companies such as Parke Davis & Co., Abbot Laboratories, Mead Johnson & Co., or E. R. Squible & Sons, at competitive rates. This system not only ensures large supplies but also facilitates the development of self-contained factories. In India on the other hand, there are no specified shark fishing seasons and there are no boats specially equipped for the purpose. The uncertainty and scattered nature of the catches do not favour the development of centralised factories for the extraction of oil but compel the necessity of encouraging production on a cottage industry basis. This system would have been satisfactory if the fishermen readily adopted improved methods of extraction advocated by the Fisheries Departments. But they still persist in following crude indigenous methods which, they believe, ensures higher yields of oil; the product is often adulterated with other oils such as turtle oil and oil of leather jackets.

Shark Liver Oil having now been generally accepted as an efficient substitute for Cod Liver Oil, the responsibility of manufacturers to maintain a high quality is indeed very great but in many cases, they seem to ignore this necessity. In Western countries, where fish oils are manufactured on a large scale, an analytical section forms an essential component of the organisation and every sample of oil, as soon as it is prepared, is tested and certified before it is placed on the market but in India though analysis has been voluntarily taken up by a few important scientific laboratories,—to whose labours much of the popularity of the oil is due—since there is no co-ordination between these laboratories and manufacturing concerns, reports of analysis have no bearing on the quality of the product offered in the market. Samples analysed are those specially prepared in the laboratories, whereas the commodity sold in the market is largely what is purchased from fishermen. The two have no comparison and in most cases, are widely different. If, therefore, the Shark Liver Oil industry in India is to be stabilised on a pharmaceutical basis, it is very essential to control production and to exercise a more vigilant supervision of the methods of manufacture.

Owing to the uncertainty of catches, the production of oil on a cottage industry basis has been regarded as the surest and the only practicable scheme, but the unreliability of the methods of extraction, complete disregard of the principles of cleanliness and the susceptibility to adulteration, are factors which argue very strongly against the continuance of this practice. If the quality and purity of the oil are to be ensured, extraction must be carried out under expert supervision during every stage in the process of manufacture and there must be an intimate co-ordination between scientific and manufacturing sections. But so long as collection and manufacture are thrown open to the public such a supervision and co-ordination will be ineffective. The only alternative, therefore, is to centralize manufacture under the supervision of Government Departments and completely exclude private agencies from direct dealings with fishermen. Such a step will ensure maximum utilization of the raw product to the best advantage without being wasted or rendered valueless by irresponsible handling or indifferent methods of extraction, and also promote the development of centralised factories.

LETTERS TO THE EDITOR

A SELF-STABILISED HIGH VOLTAGE SOURCE FOR GEIGER COUNTERS

Several methods* of obtaining stabilised high voltages have been described. In all of them, a separate rectifier and a separate stabiliser, bias batteries, etc., have been used. A self-stabilised high voltage source is being developed and its circuit is shown in Fig. 1.

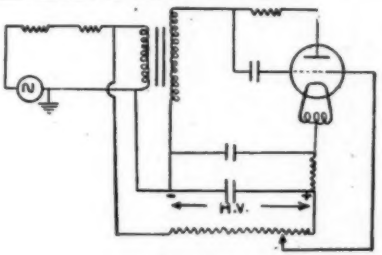

Fig. 1

The circuit is self-explanatory. By introducing an air gap in the central leg of the high voltage transformer, some degree of stability is obtained. By adjusting the bias to the grid of the rectifier, the stability is increased. Feeding back the D.C. output current to the primary further improves the stability of the output voltage. The coupling between the plate and grid by a condenser reduces the ripple to an unnoticeable extent and also improves the stability. The primary circuit contains lamp resistances which reduce surges and regulate the output voltage.

In such a circuit, it is found that a mains voltage variation of 60 volts in a 230 volt supply produces a variation in the output voltage of less than 10 volts. An output current change of ten micro-amperes produces no perceptible change in the output voltage. In this circuit, a power tube of the receiving type is used and as such cannot be operated with a high current drain at voltages above 1,000 volts. Consequently the polarisation of the core by D.C. flow has to be reduced considerably at such voltages. Even if this is done, the worst instability obtained corresponds to one volt in the output per one volt change of the mains voltage. A complete description of its operation will be published in due course.

Cosmic Ray Research Unit,
Indian Institute of Science,
Bangalore, S. V. Chandrashekhar Aiya.
August 16, 1943.

* Webster, *Proc. Camb. Phil. Soc.*, 1931, **28**, 121. Street and Johnson, *J. Frankl. Inst.*, 1932, **214**, 155. Richards, *Rev. Sc. Inst.*, 1933, **4**, 479. Evans, *Ibid.*, 1934, **5**, 371. Ginrich, *Ibid.*, 1936, **7**, 207. Ashworth and Muzon, *Ibid.*, 1937, **8**, 127. Neher and Pickering, *Ibid.*, 1939, **10**, 53. Hartman, *Electronics*, 1932, **6**, 43.

THE TEA POLYPHENOL OXIDASE—ITS MATERIAL NATURE

In previous studies[1] the tea oxidising enzyme was characterised as a polyphenol oxidase, mainly by reason of its substrate specificity. The question then arose whether tea oxidase was also analogous in its material and chemical nature to such other polyphenol oxidases[2,3] which are known to be copper-protein compounds.

Copper has been detected in all preparations of tea enzyme. But the crude preparations were found also to contain manganese and iron, both associated with other types of oxidising enzymes.[4,5] On purification, however, iron and manganese were completely eliminated from the enzyme while the preparations got enriched in their copper content.

The purification of enzyme was effected as follows:—The acetone preparation of the enzyme was extracted with Sörenson's glycine buffer at pH 10·1, and after adjusting the pH of extract to 6·0 the enzyme was precipitated by a fractional saturation with Am_2SO_4. The precipitate obtained between half and full saturation was collected, dispersed in water and dialysed. Further purification consisted in an adsorption on freshly prepared calcium orthophosphate gel and subsequent elution. By this method tea oxidase has been purified to a concentration of at least 800 times that present in fresh leaf.

Some typical results for the activities and the copper contents of the preparations during the different stages of purification are given

below. Activities represent mg. ascorbic acid oxidised in a catechol-ascorbic acid substrate in 1 hour at room temperature.

Stage of Purification	Activity per g. dry enzyme	Cu content μg per g	Cu per unit activity
1. Acetone prepared enzyme	151	32	0·21
2. Crude extract	330	60	0·18
3. Am_2SO_4 full saturation precipitate	3546	335	0·09
4. After one adsorption on Ca_3PO_4 gel and elution	5000	357	0·07
5. After a second adsorption and elution	10100	800	0·08

Thus in the more active preparations there exists a fair proportionality between activity and copper content, showing thereby that Cu forms the active group of the enzyme.

Further proof of this is furnished by the fact that on dialysis against KCN solution tea oxidase becomes completely inactivated due to removal of the bound Cu.

It is, therefore, concluded that tea oxidase is a metallo-protein with Cu as its prosthetic group. As such it takes its place along with the other polyphenol oxidases whose constitution and mechanism have been fully worked out.

Tea Research Institute of Ceylon,
Talawakelle,
Ceylon, H. B. SREERANGACHAR.
June 10, 1943.

1. Lamb and Sreerangachar, *Biochem. J.*, 1940, **34**, 1472. 2. Kubowitz, *Biochem. Z.*, 1938, **299**, 32. 3. Keilin and Mann, *Proc. Roy. Soc.*, 1938, **B125**, 187. 4. Bertrand, *Compt. Rend.*, 1895, **121**, 726. 5. Green, *Mechanism of Biological Oxidations*, 1940, p. 11, Cambridge.

PREPARATION OF DIAZOMETHANE

A FAIRLY quick and economical method of preparing diazomethane from acetamide is described.

The preparation of diazomethane by Arndt's method[1] is expensive and the starting substance, methyl urea, is not readily obtainable. An alternative method has been suggested by Adamson and Kenner[2] which is economical but which involves long and troublesome preparative work.

During work on the synthesis of the ketonic terpene, umbellulone from isovalerianic acid, and of caryophyllanic acid, supplies of diazomethane in quantity were required and a method of preparation from acetamide, based on the work of Brüning[3] was found economical and quick.

EXPERIMENTAL

Aqueous sodium hydroxide (10 per cent.) was added slowly to acetamide (100 gms.) and bromine (45 c.c.) with shaking until the solution was permanently pale yellow, first with ice-cooling and then after heating on the water-bath. On cooling, the acetyl methyl urea (m.p. 179-180° C.) was collected, a further quantity being obtained by concentration of the filtrate (total yield 75 gms.). The acetate was hydrolysed by heating for 3 hours with 8 per cent. hydrochloric acid (200 c.c.), the solution cooled in ice and a saturated solution of sodium nitrite (37 gms.) added with the stem of the tap funnel below the level of the liquid. The nitrosomethylurea (52 gms.) was collected, washed with a small quantity of cold water, and dried in a vacuum. The nitrosomethylurea may be stored in quantity provided it is kept at 0° C., as at ordinary temperature it decomposes slowly.

Diazomethane was then prepared in ether solution by adding aqueous potash and ether to the nitrosomethylurea and distilling from a water-bath at about 60° C.

This work was carried out in the University College of North Wales, Bongor, under the direction of Dr. G. R. Ramage and Prof. J. L. Simonsen.

Inspectorate of Military Explosives,
Kirkee, M. D. OWEN.
August 14, 1943.

1. *Organic Syntheses*, **15**, p. 48. 2. *J.C.S.*, 1937, p. 1551. 3. *Ber.*, 1888, **21**, 1809; and *Annalen*, 1889, **253**, 6.

A NOTE ON THE ALKALOIDS OF *COSCINIUM FENESTRATUM* (COLEBR.)

THOUGH previous workers[1,2] had suggested the presence of the alkaloid berberine in the stems, Katti and Shintre,[3] in the course of a complete investigation of the stems, noted the probable presence of two alkaloids. They reported that the alcoholic extract of the plant stems contained ceryl alcohol, hentriacontane, sitosterol, palmitic and oleic acids, sitosterol glucoside, saponins, glucose and a large amount of a mixture of alkaloids, together with some resinous material. The melting points of the two alkaloids obtained by them in a pure condition did not correspond with that of berberine recorded in the literature (145° C.).

The present work was undertaken to verify the presence or absence of berberine and of any other alkaloid.

An alcoholic extract of the roots was thoroughly extracted, first with water and then with dilute acetic acid. The insoluble residue did not give any test with alkaloidal reagents. From the aqueous and acetic acid extracts the alkaloids were completely precipitated as nitrate (1·6 per cent.) by adding a solution of potassium nitrate. The filtrates did not show the presence of any other alkaloid in solution. The yellow alkaloidal nitrate was found to contain only berberine from a study of the nitrate, the hydrochloride, the platinichloride and the acetone compound as well as the free base regenerated from the acetone compound. These compounds were compared with the corresponding compounds prepared from pure berberine and found to be identical. The free base also gave the usual colour reactions for berberine.

As a result of the investigation it was proved beyond any doubt that the alkaloidal content of *Coscinium fenestratum* consists of berberine

only. The alkaloidal crystals obtained by Katti and Shintre, and also obtained by us by following their method, were not free berberine but salts of berberine and, therefore, naturally did not give the melting point of pure berberine. Presumably they were salts of two different acids, as they obtained crystals with two different melting points. It was not thought to be of sufficient importance to isolate and identify these acids.

EXPERIMENTAL

The drug was purchased from a local dealer and identified in the botanical department of the University College.

The powdered air-dried stem (180 gms.) was defatted with petrol and soxhleted with alcohol. From the alcoholic extract (9·2 gms.) warm water dissolved 6·2 gms. From the insoluble residue, the remaining alkaloids were dissolved out with warm 4 per cent. acetic acid and precipitated as nitrate with strong potassium nitrate solution (A).

The aqueous extract, on concentration and cooling, gave a crystalline alkaloidal material (·8 gm.; B), which was also converted to the nitrate. The aqueous filtrate, also gave a nitrate (2·6 gms.; C).

BERBERINE-ACETONE COMPOUND

0·1 gm. of the nitrate was dissolved in water (10 c.c.) and mixed with 2 c.c. of 10 per cent. aqueous sodium hydroxide, heated to 50° C. mixed with 5 c.c. of acetone and set aside. A lemon yellow powder separated. Melting point 167-169° C. (decomp.).

BERBERINE REGENERATED FROM ACETONE COMPOUND

The free base was liberated from the acetone compound by boiling 0·2 gm. of it with alcohol on a water-bath. The alcohol was driven off and the residue recrystallised from water. It melted at 145° C. both alone and after admixture with a sample of pure berberine.

The authors thank Dr. K. L. Moudgill, Director of Research, for his interest in this work.

Central Research Institute, Trivandrum, *June* 11, 1943.

N. S. VARIER.
P. P. PILLAI.

1. Perrins, *Ann.*, **83**, 276 2. Chopra, *Indian Medicinal Plants*, p. 295. 3. Katti and Shintre, *Arch. Pharm.*, 1930, **268**, 314-21.

CATALYSIS OF VANADATE-HYDRIODIC ACID REACTION BY THE OXALATE ION

IN a previous publication[1] we reported the catalysis of the reaction between dichromate and hydriodic acid by the oxalate ion. We have carried out a survey of numerous reactions involving the oxidation of hydriodic acid by such substances as hydrogen peroxide, potassium persulphate, sodium arsenate, potassium chlorate, potassium bromate, and potassium iodate to ascertain the possible catalytic effect of oxalate ion. No catalytic effect was observed in these cases. It was, however, found that the oxalate ion has a profound accelerating action on the reaction between vanadic acid and hydriodic acid.

The reaction was followed by titration of the iodine liberated with sodium thiosulphate. The concentration of sodium vanadate was varied from 0·025 N to 0·00025 N and that of sodium oxalate from 0·225 N to 0·0005 N. The reaction was studied in the presence of air, in vacuum, and in an atmosphere of carbon dioxide.

In seeking an explanation for the mechanism of the catalytic action of oxalate ion on these reactions, we have to take into account the numerous resemblances between chromates and vanadates. Both chromic acid and vanadic acid form poly-acids, and, possibly, complexes with oxalic acid. It seems, therefore, that in the reaction between chromate and hydroidic acid, the oxalate catalysis is more concerned with the chromate than with the hydriodic acid. This idea received further support from our recent observation[2] that the reaction between dichromate and hydrobromic acid is also catalysed by oxalate.

Full details will be published elsewhere.

Andhra University, *July* 6, 1943.

C. R. VISWANADHAM.
G. GOPALA RAO.

1. Viswanadham, C. R., and Gopala Rao, G., *Curr. Sci.*, March 1942, **11**, No. 3, pp. 102-103. 2. *Ibid.*, June 1943, **12**, No. 6.

A NEW STEM-BASE DISEASE OF *ALTISSIMA* CAUSED BY A SPECIES OF *PHYTOPHTHORA*

FOR the first time during the year 1930 *Phytophthora* was reported[1] by this section to cause diseased lesions on the stem of altissima (*Hibiscus sabdariffa* Lin. var. *altissima*). *Altissima* supplies the Roselle Hemp of Commerce, and is noted for its good silky fibres, much stronger than jute and can be used in some proportion in the manufacture of ropes, cordage, etc.

The disease as observed since 1930 is characterised by the production of discoloured patches on the stem. If the stem is still green, the patch appears at first as a water-soaked, slightly yellow patch at the base of the stem; with time the lesion enlarges, darkens and becomes brown in colour and the infected tissues (the excambial layers) dry up resulting in shreds and cracks and thereby exposing the pith inside. Ultimately the leaves begin to wilt and the plants gradually dry up and die prematurely. In case they do not completely succumb, the fibres at the infected regions are damaged thereby depreciating greatly the quality of the yield.

The first infection usually takes place on the lower portion of the stem and more often near about the collar region; but the production of these lesions are confined within 2 to 3 feet from the ground level. The number of lesions in any single plant varies from a few to half a dozen and the size of the individual lesions from half an inch to many inches in length and may partially or completely girdle the stem. One or more lesions may coalesce together to form diseased surface of considerable length. If rain or very humid conditions prevail for a number of days gums are sometimes seen exuding from old and large lesions; such conditions also favour the growth of fungus mycelium from the margins of these spots.

The plant may be attacked at any stage of

its growth—from seedling till when almost full grown. But the attack and the spread of the disease is much favoured by the continued presence of damp, cloudy days or rains. Once started the lesions grow on and are not much hampered in their progress despite changes in weather conditions. But it must be stated that few new infections take place under dry conditions.

Cultures of diseased tissues as well as inoculation experiments have demonstrated that the pathogen responsible for this malady is a species of *Phytophthora*. This species of *Phytophthora* produced good growth of mycelium as well as sporangia in potato-dextrose-agar medium. The sporangia are ovoid in shape, measuring from 19·2-48 $\mu \times$ 18·0-33·6 μ with papilla 4·8-7·2 μ; vegetative hyphæ varying from 4·8-9·6 μ in width.

Detail work regarding the specific identification of the fungus, its physiological behaviours together with control measures are in progress.

Our thanks are due to Dr. S. Hedayetullah, for his kind interest.

Section of the Economic Botanist,
Agricultural Research Station, P. C. KAR.
Dacca (Bengal), J. C. SAHA.
June 11, 1943.

1. *Ann. Rept. of the 1st Economic Botanist to Govt. Bengal, for the year 1930-31* (*Abs. Rev. Appl. Myco.*, 1931, **11**, 157-58).

KARNAL BUNT, AN AIR-BORNE DISEASE

IN a recent paper[1] I have shown that the bunt of wheat caused by *Neovossia indica* (Mitra) Mundkur is not a seed or soil-borne disease, experiments conducted during four years having given consistently negative results. These experiments have been repeated in 1942-43, not only at New Delhi but at Simla and at the Tarnab Farm, Peshawar, but with uniformly negative results. In the crop year 1941-42, bunt appeared in an epidemic form and at Karnal, up to 35 per cent. of the ears were infected. Seed from that crop was sown in the same fields in 1942-43 and the crop carefully examined. There was little or no bunt and only nine infected ears were found after careful search. These additional data further confirmed the belief that Karnal bunt is not seed or soil-borne. It will be noted that the experiments were designed with the idea that this bunt like a majority of bunt and smut diseases is a systemic disease, infection taking place in the seedling stage. Examination of a large number of ears attacked by *Neovossia indica* and of some attacked by *Tilletia caries* (DC.) Tul. or *Tilletia fœtida* (Wallr.) Liro, has shown that such is not the case.

Plants infected by *Tilletia caries* or *Tilletia fœtida* are sometimes dwarfed and bluish green to greyish green. The bunted ears are darker green and remain so longer than the normal heads. Attacked plants may be wholly or partially bunted. Even though a majority of the heads are completely attacked, partially attacked heads are known, half the ear or one side or one edge alone being infected. In a partially bunted head the bunt balls and the kernels are not distributed irregularly; in fact, the former stand by themselves one above the other in a regular manner. McAlpine,[2] while granting that partially bunted kernels are exceedingly rare, has on some occasions found them. Recently Gassner[3] found that in Turkey wheat kernels partially infected by *Tilletia fœtida*, are more common but their mode of occurrence makes it clear that initial infection must be from an internal systemic mycelium.

As a rule the fungus attacks each growing-point of the stool at an early stage but some tillers may escape infection, the later ones not succeeding in escaping, so that partially bunted plants result. Sometimes the fungus may be confined to a part of the meristem, resulting in a strand of infected tissue below the growing point and a bunted strip along one side of the head alone. These are, however, extremely rare cases.

As against these symptoms, the plants infected by *Neovossia indica* are never dwarfed nor is their colour changed. An ear in which all

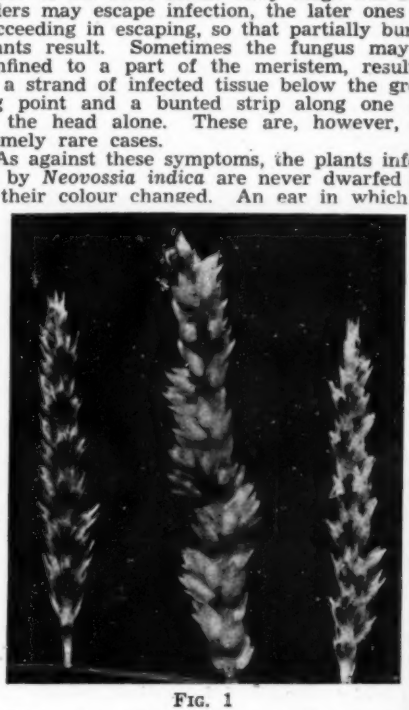

FIG. 1

Tilletia caries on right. *Neovossia indica* in centre and *Tilletia fœtida* on left.

the grains are infected has not yet been seen. Not more than five or six kernels in a head are attacked, of which one or two are turned into complete smut balls, the rest of the attacked kernels being partially attacked. The remaining kernels in the head are unaffected. The attacked kernels occur very irregularly and do not conform to any ordered arrangement; in fact the kernels at the base may be perfectly healthy but two or three at the centre and a few at the apex may be affected. The mode of attack of the kernels makes it manifest that initial infection must have been external. Such a condition is the rule rather than an exception in this bunt. Examination of bunted ears indicates that *Tilletia caries* and *Tilletia fœtida* are ovaricolous and *Neovossia indica* is fructicolous. Furthermore, the irregular manner of occurrence of infected kernels in the latter indicates that only those grains are infected where the spores brought

by an external agency have settled down, each bunted grain representing a single, strictly local infection.

Apparently the spores or the sporidia wafted by wind settle down on the ears in the "anthesis" or the "dough" stage and the kernels ultimately get attacked. At that time the spores are not formed in the heads but those of the previous season lying about in the fields on stubble or other wheat refuse, evidently germinate in January or February when there is enough moisture and sufficiently low temperature, forming promycelial tubes, at the apex of which a whorl of sporidia, up to 150 or even more, is formed. The large number of sporidia ensures that some of them at least will find the congenial host. In the other two bunts the number of sporidia is eighteen to twenty, but they being seed-borne, the spores lie in close proximity of the host and it is not necessary to produce a larger number. The Promycelial tubes of *Neovossia indica* are rather long, which ensures that the sporidia if buried, reach the surface with every chance for being carried by wind. The spores themselves are rather large; but the sickle-shaped sporidia are light and can be easily carried by wind. The spores evidently play a passive part, the aggressive parasitic role being assumed by the sporidia.

To prove the above assumptions experiments were carried out at Delhi and at Simla during the past season with successful results. Moore's[4] vacuum method of infecting the ears was used. Prior to infection the spores were in some cases soaked for four days and after infection the heads were labelled and covered with paper bags. Infections were made in February and March at Delhi and in April at Simla.

At Delhi, five out of five infected ears of IP 114 and two out of six ears of IP 165 showed attack and in the infections carried out at Simla, six out of sixty-four of IP 165, twelve out of fifty-four of C 591, and twenty out of 303 of IP 125 were bunted. This is the first occasion when such a large number of artificially bunt-infected ears has been obtained. Instead of using the spores had I used sporidia, the percentage of infection would have been greater. Unfortunately the germination of the spores is very capricious and the exact conditions for obtaining uniform germination are unknown. Effort will hereafter be directed towards finding those conditions. Very low temperature and sufficient quantity of moisture appear, however, to be necessary. In 1942 there were 2·54 inches of rain in the second half of January and 4·51 inches in February, as against traces and 0·15 inches, during corresponding periods in 1943, at Karnal. There was not much difference, however, in the temperatures. Bunt appeared in an epidemic form in 1942 while it was scarce in 1943, apparently due to the above cause.

Imperial Agricultural Research
Institute, New Delhi,
July 5, 1943. B. B. MUNDKUR.

1. Mundkur, B.B., *Indian J. Agric. Sci.*, **1943**, **13**, 54-58. 2 McAlpine, D., *The Smuts of Australia, Melbourne*, 1910. 3. Gassner, G., *Phytopath. Z.*, 1938, **11**, 451-68. 4. Moore, M., *Phytopathology*, **1936**, **26**, 397–400.

A NEW RUST DISEASE OF CARDAMOMS

A LEAF-RUST on *Elettaria cardamomum* Maton was collected by the writer in the plantations round about Balehonnur which, on examination, appeared to be a species new to science. No rust-disease of the cultivated cardamoms are known to occur in India or any other country, and Mayne[2] makes no mention of any cardamom rust in his recent report on the cardamom cultivation in India. The infection first appearing as a tiny yellow spot gradually spreads into a patch. The sori that are formed throw up masses of powdery white spores. After the dispersal of the spores the infection patches dry up appearing as blotches formed by sun scorch. The mycelium continues to perennate along the margin of the dried patch, and when conditions are favourable they develop fresh sori. The rust is widely distributed in South India, rusted specimens having been collected by the writer in the various estates of Kodaikanal Hills and plantations in the Mysore State.

Only uredia have been observed for the rust. They are subepidermal, erumpent and pulverulent, white and aparaphysate (Fig. 1). The urediospores arise singly on short pedicels, and

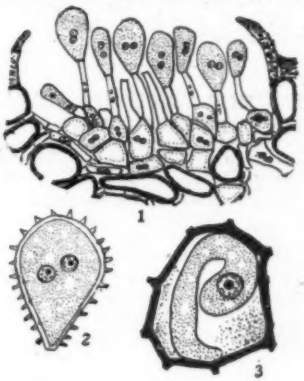

FIG. 1. Uredium × 560.
FIG. 2. Urediospore × 1,800.
FIG. 3. Haustorium within the host cell × 1,260.

distinctly show a binucleate condition. Mature spores are ovate-elliptic (Fig. 2), white, echinulate, with an indistinct germ pore and measuring 26-32·5 × 19-17·4 μ. The urediospores reinfect the same host and cause secondary infection.

The only other rust recorded on the genus *Elettaria* is *Schroeteriaster Elettariæ* recorded by Raciborski[3] from Java on *Elettaria speciosa*. The urediospores of this rust are stated to be ovate-elliptic, orange-yellow, and measuring 24-30 × 15-20 μ and telia in subepidermal lenticular crusts with hyaline teliospores in short chains. Mains[1] who critically examined the type species of *Schroeteriaster* noticed that in addition to the characters ascribed for the genus, persistent hyaline basal cells were also present, a character which clearly distinguished the genus from *Phakopsora* and *Bubakia*. In one instance what appeared to be an immature telium, composed of binucleate superposed

cells was observed by the writer. In the absence of any mature telium it would be best to retain the rust under *Uredo*. The urediospores of *Schræteriaster Elettariæ* are orange-yellow, measuring 20-34 × 15-20 μ as against the hyaline spores of the rust under study which measure 26-32·5 × 19-27·4 μ. The rust can be accommodated only as a new species and the name *Uredo Elettariæ* Thirumalachar is proposed.

Uredo Elettariæ THIRUMALACHAR SP. NOV.

Uredia amphigena, subepidermalia, erumpentia, albida et aparaphysta; urediosporæ ovatæ-ellipsoidæ, echinulatæ, poris germ. indistinctis, magnitudinis 26-32·5 × 19-27·4 μ. Hab. on vivis foliis *Elettaria cardamomum* Maton, leg. M. J. Thirumalachar, 14-4-1940, Balehonnur, Mysore State, type deposited in the Herb. Crypt. Ind. Orient, New Delhi.

Department of Botany,
Central College,
Bangalore, M. J. THIRUMALACHAR.
July 6, 1943.

1. Mains, E. B., "The status of the genus *Schræteriaster*, *Ann. Mycol. Berl.*, 1934, **32**, 256–59. 2. Mayne Wilson, W., Report on Cardamom cultivation in South India, *Misc. Bull.* No. 50. *Imp. Counc. Agri. Res.*, India, 1942, pp. 1–67. 3. Raciborski, M., *Parasitische Algen und Pilzen Javas*, 1900, **2**, 28–29.

PYRETHRIN CONTENT OF INDIAN PYRETHRUM

DURING the past few years much interest has been taken in the cultivation of pyrethrum (*Chrysanthemum cinerariæfolium* Boic.) in India and with the help of the Imperial Council of Agricultural Research experimental cultivations have been started at a number of stations. As reported by Burns,[1] pyrethrum has failed to establish itself at Dharwar, Poona, Saharanpur, Dehra Dun, Chaubattia (Ranikhet U.P.), Sakrand (Sind), and Ranchi, but the attempts have succeeded at Murree, Kulu, Palampur, Kashmir and since the time of the above report, also at Shillong, Mayurbhanj, Kodaikanal, Coonoor and Mysore.

It is well known that success in the cultivation of pyrethrum depends upon the type of soil, altitude of the locality, climate, distribution of rainfall, cultural and manurial treatment, conditions of flowers at harvesting, etc. Full data are not yet available for all the stations where pyrethrum has been a success and in their absence it is not possible to discuss the reasons why the pyrethrum grown at Kodaikanal is superior to that grown in Murree but it may be stated that the Indian experiments appear to prove what has been established elsewhere, namely, that pyrethrum grows best in localities with 40-80 inches of rainfall, well distributed throughout the year. Pyrethrum failed to flourish in Dehra Dun because of nearly 60 inches of rainfall during the three rainy months, which damped off the plants.

In the following table the pyrethrin content of pyrethrum flowers (open), obtained from different localities, is recorded and for comparison the figures for Kenya, Japanese and Dalmatian flowers are also given. All the figures given in the table are comparable, as they have been obtained by the same method

Locality	Altitude	Annual rainfall	Normal rainfall in July, August and September	Pyrethrin I	Pyrethrin II	Total Pyrethrins
Kashmir	ft.	in.	in.	%	%	%
Tangmarg	7,200	15 + winter snow	11	0·35	0·57	0·92
Baramulla	5,200	38	6	0·32	0·62	0·94
Punjab						
Palampur	4,500	101	72	0·22	0·68	0·90
Murree	7,113	57	31	0·37	0·66	1·03
Kulu	4,500	39	15	0·35	0·40	0·75
N.W.F. Province						
Tarrab	2,000	17	6	0·31	0·59	0·90
United Provinces						
Dehra Dun	2,239	87	59	0·63	0·15	0·78
Garhwal						
(Pandar range)	4,000	70	44	0·29	0·28	0·57
Madras						
Kodaikanal	7 688	62	19	0·76	0·62	1·38
Coonoor	5,730	64	10	0·44	0·45	0·89
Assam						
Shillong[4]	4,921	84	40	—	—	1·41
Orissa						
Mayurbhanj[5]	1,600	60	32	—	-	1·15
Mysore						
Bangalore[5]	3,021	35	16	—	—	0·8(
Kenya	7–9,500	40–65	—	0·77	0 56	1·33
Japan	—	40–80	—	0·38	0·63	1·01
Dalmatia	—	40	—	0·35	0·63	0·98

of assay, namely, a combination of Seil[2] and Pantsios.[3]

Forest Research Institute,
Dehra Dun, S. V. PUNTAMBEKAR.
June 6, 1943.

1. Burns, *Indian Farming*, 1941, **2**, 58. 2. Seil, *Chem. Trade J.*, 1934, **85**, 168. 3. Pantsios, *Ind. and Eng. Chem.*, Anal. Ed., 1935, **10**, 386. 4. Chakrabarti, *Indian Farming*, 1942, **3**, 12, 652. 5. Anon, *Ibid.*, 1942, **3**, 8, 441. 6. Lahiri, Ghose and Chopra, *J. Amer. Pharm. Assoc.*, 1941, **30**, 72.

THE *KURRAM SANTONICA*

THE *Kurram santonica* has been commercially exploited for manufacturing santonin since 1927. On account of its great economic value its cultivation has been considerably extended in the valley resulting in a remarkable increase in the annual yield. Repeated attempts were made in the past to introduce the Kurrum santonin into the adjoining territories of the Khyber, Waziristan, Malakand agency, Chitral and Kaghan, but so far these have not been successful. The failure is chiefly due to defective methods of cultivation.

Krishna and Varma[1] attempted to grow artemisia at Dehra Dun, and they reported that the plant raised from seeds obtained from the santonin containing Kurram *Artemisia* "produces flower-heads twice a year and consequently has two periods of maximum santonin content, namely, June and December".

It may be pointed out that the climatic conditions during the months of June and December are entirely different. The appearance of two regular crops of flower-heads and leaves on the same branches of the same plants during two extremely different climatic conditions is most extraordinary. With regard to *Artemisia* growing under natural or proper cultural conditions such a phenomenon is least expected. There is no evidence available from any other quarter in support of it. Two periods of maximum santonin content at two different flowering periods during one year is not only out of harmony with their previous finding but is also not a natural phenomenon as far as *Artemisia* is concerned.

In the case of the *Kurram santonica*[3] there are two maxima from the point of view of santonin content. One when the new leaves are fully developed in late spring and the second when the immature unopened flower-heads are well developed.

Artemisia has been under cultivation in the botanic garden of the Islamia College for the last ten years. The plants were raised from seeds brought from the Kurram valley and the Khyber. Transplants were also brought. All the plants are doing very well. I have been carefully watching the appearance of flower-heads of the santonin-containing as well as the santonin-free forms of *Artemisia*. I have been several times to the Kurram valley, Khyber, Waziristan, Kaghan valley, Baluchistan and some parts of Afghanistan, where *Artemisia* grows wild in great abundance. I[2] have "in no case observed the normal appearance of two (regular) crops of flower-heads in a year" on the same plants. It has, however, been observed in the case of santonin-free and some hybrid forms, that the flowering is late as compared with the genuine santonin-containing form and the flowering period is very much prolonged with the result that in some cases the plants bear fresh flower-heads side by side with old withered flower-heads. In the case of the genuine santonin-containing form the flowering period is earlier and comparatively much shorter."

Moreover, in the case of some cultivated plants it was observed last year that if the vegetative shoots are cut off just before the appearance of the flower-heads, the flowering period is much delayed. Further work in this connection is in progress.

Islamia College,
Peshawar, M. A. QAZILBASH.
June 14, 1943.

1. Krishna and Varma, *Quart. J. Pharm. Pharmacol.*, 1933, **6**, 23. 2. Qazilbash, *Ibid.*, 1942, **15**, 323. 3. Coutts, *Ibid.*, 1934, **7**, 404.

THE cultivation of *Artemisia* in Dehra Dun was attempted on the strength that the plant being Zerophytic would perhaps flourish even in a wet locality. Our experiments have shown that given proper care, *Artemisia* can be grown but that Dehra Dun is not a fit place at all. Therefore these experiments have long been dropped and the observations made earlier have never had the opportunity of being checked.

The plants that showed two flowering periods were remnants that had survived three monsoons. In Dehra Dun *Artemisia* starts growing in April and the flowerheads appear in June. These flowerheads drop off in July when the monsoon has settled and the plant shows, in general, a sickly appearance but starts giving new shoots and flowerheads as soon as the monsoon is over.

This records our observations but it is difficult to offer an explanation especially when the plant has been grown in a climate so different from that of its natural habitat. It is possible that if the monsoon were not so heavy (about 70 inches in July, August and September) the flowerheads formed in June would have opened in due course without being killed and a second flowerhead would not have been formed after the rains. Mr. Qazilbash cites the case of delayed flowering in hybrid forms of *Artemisia* which is interesting reading in this connection.

Bio-Chemist,
Forest Research Institute,
Dehra Dun, S. KRISHNA.
July 20, 1943.

REVIEWS

pH IN PRACTICE

Hydrogen Ions, Their Determination and Importance in Pure Industrial Chemistry. Vols. I and II. By H. T. S. Britton. (Monographs on Applied Chemistry Series). (Chapman and Hall, Ltd., London), 1942, Third Edition. Vol. I pp. xix + 420, price 36*sh.*; and Vol. II pp. xix + 443, price 36*sh.*

One of the significant developments in industrial control and practice in the last decade and more has been the rapidly increasing recognition of the important role played by pH in many of the methods of industrial processing. Such developments have obviously run hand in hand with the increasing necessity for automatic and precise controls in large-scale productions of high quality and uniformity at competitive prices. The field controlled by hydrogen ions ranges from such subjects as ceramics and soil fertility to a multitude of the more obvious practices such as Textile and Dye Industry, Water Purification, Corrosion, Sewage Disposal, Baking, Brewing, Pulp and Paper Manufacture, Tanning Processes, Sugar Manufacture, Methods of Electro-Deposition and, finally, the important subjects of analytical and separation methods in Inorganic Chemistry. Thus the production of satisfactory paper depends on the efficient adjustment of the hydrogen ion concentration of the liquors employed, and more particularly in the sizing operations, as this determines the final quality of the paper; printers often find that their types and plates deteriorate more rapidly when used on some papers than on others although all were purchased as being of the same quality. In the manufacture of sugar the careful regulation of acidity and alkalinity of the various sugar solutions during the purification process has always been a problem of paramount importance. The control of hydrogen ion concentration in textile processes is a matter of definite practical importance, more particularly in the wet processing of ampholytic substances silk and wool, and especially their dying. Developments in biochemical researches have shown that in order to secure or avoid the optimum activity of enzymes and bacteria, specific ranges of hydrogen ion concentrations have to be established. A striking example is the effect of the less extreme variations in hydrogen ion concentration in the soil, which modify the distribution and activity of its teeming population of micro-organisms besides affecting the condition of plant nutrition. This has also a bearing on the incidence and severity of many plant diseases. Other biochemical processes in which hydrogen ion concentration is a useful index are the control and execution of the different preliminary stages of leather manufacture, the methods of mashing, malting, brewing and fermentation, the preservation of milk and other dairy processes, the baking industry, sewage disposal, etc. As is well known the measure of hydrogen ion concentration is of fundamental importance in inorganic chemistry. Apart from the possibilities of potentiometric titrations, analytical and other processes involving precipitation of hydroxides and basic salts can be kept under perfect control by maintaining the appropriate pH value as indicated by colorimetric or electrometric methods. This specificity of pH for the precipitations of insoluble salts also underlies the need for a careful regulation of hydrogen ion concentration of the solutions from which certain basic metals such as nickel, cobalt, iron and manganese are cathodically deposited. The variations in the tanning properties of chrome solutions are in a similar way controlled by relations between pH and phenomena of "soluble basic salt" formation. It is interesting also to note how pH controls the simple and differential flotations of ores.

Prof. Britton's monograph is a storehouse of much valuable information on each of the topics briefly mentioned above and much else besides in the form of tables and graphs. The industrial applications are all considered in Volume II in a succession of chapters from XXII to XLVI. Volume I deals essentially with the several practical methods of pH measurement and control, leavened with just that amount of the fundamental theories of electrode potentials and behaviour of ions in solutions and ionisation constants, as will help to anchor the reader to the realities of his measurements. A new chapter XXI on Redox potentials makes up for a serious omission in the previous 1931 edition of this book. The reviewer is in agreement with the author in the limits set by him to the exposition of the theoretical concepts. This makes the book readable to the less initiated as well.

Altogether, this new edition is a very welcome publication and should be opportune to the large number of physical chemists who are now actively engaged in "essential war services". There is a 50 per cent. increase in the number of pages over the 1931 edition due to incorporation of new chapters and revision and substantial additions to old. This has obviously necessitated the split of the monograph into nearly equal volumes of more convenient size. It is, however, less obvious why the pages in second volume are numbered afresh while the figures and tables and chapters are all numbered in continuation of volume one. The printing and paper are of a high pre-war standard while the cost reflects the war-time conditions. This publication must find a place in every industrial and university library.

M. A. G. RAU.

Intermediate Practical Physics. By Prof. Vissa Appa Rao. (Andhra University Series No. 28, Waltair), 1942. Pp. viii + 337. Price Rs. 4.

It is a happy augury for the future that more and more science text-books are being produced in India, which can really be called text-books and are not merely "Notes" or "Cram" books. The present book is a good example of the excellent volumes that are now seeking

to supply the wants of Indian students and is apparently the handiwork of an experienced teacher. It gives a description of those experiments which constitute the course in practical Physics for the Intermediate Examination of Indian Universities, with fine model results set out for every experiment. A concise presentation of the underlying theory precedes the description of the experiment and it is surprising to see the amount of theory compressed into a short space in this way. The course of experiments is that common to most Indian Universities and the apparatus described is also mostly standard. The same absence of superfluous words characterises the description of the experiments, as was noticed in the presentation of the theory. Now and again a question is interposed with a 'why' or a (?) which serves to draw the student's attention to important points worth careful thought. The language is adequate and acceptable, barring a few slips here and there, such as 'compass' for 'compasses', 'a point "impressed by" forces' for 'a point "acted upon by" forces', 'slow motion "affected" with the help of a screw' for "effected", etc., 'small boats and "rafters"' for 'rafts', etc., the symbols ' and " for minutes and seconds of time instead of m and s and so on. There are a few wrong statements which require correction. For example, it is stated that as the elasticity of a fluid is independent of direction, the pressure at any point is communicated equally in all directions. In explaining the relative expansion of a liquid inside a flask, it is stated that a point on the neck coinciding with the initial level of the liquid changes position owing to the expansion of the vessel and thus prevents the full expansion of the liquid from being noticed. Surely it is not merely the motion of such a point of reference but the expansion of the whole vessel that affects the observed expansion of the liquid. The statement that "molecules have the same properties as the body, and any further subdivision of these destroys their characteristic physical properties" should be removed at the first opportunity. To say that "the incident rays, reflected rays and the normal are in the plane of the paper and this verifies the first law" is not correct; when only the marks left by the pins on the paper are joined, how has it been proved that the incident and reflected rays lie in the plane of the paper? We have indicated these errors only because we feel that the book is a good one which will certainly gain a well-deserved wide currency and we should like it to be as free as possible from such blemishes. A verification of the fact that a reflected ray turns through twice the angle through which the mirror turns, and of the lateral shift of the emergent ray in refraction through a slab may be included. The printing and get-up of the book leave nothing to be desired. We feel quite certain that the book will have a richly deserved popularity among Intermediate students all over the country, and we heartily recommend it to the attention of all teachers handling Intermediate Classes.

T. S. S.

Electric Power System Control. By H. P. Young. (Chapman and Hall), 1942. Pp. 319 + xii. Price 25*sh.*

This book is the eleventh volume of the series of monographs on electrical engineering subjects coming out under the editorship of Mr. H. P. Young.

In this book the author (Mr. Young himself) has succeeded in bringing together all the latest and important information on the subject of system control and presenting it in a coherent and readable form. It is, therefore, very useful to the power supply engineer who cannot afford the necessary time to go through the voluminous mass of available literature on the subject. To engineers in India who very often have no access to good technical libraries it must have an especial appeal. The advanced student of the subject also finds in it much that is of value to him.

The scheme of the book is as follows. There is an introductory chapter on the parallel operation of generators and characteristics of exciters. The two that follow deal with the various aspects of voltage control of alternators and describe the several auxiliaries employed for voltage regulation. We then have in another chapter a good description of the more important synchronising gears in use to-day. The next four contain a treatment of the various aspects of system design such as control of power transfer, circuit breakers and circuit interruption, short circuit calculation and protection, and all the other complex problems, theoretical and practical, arising out of the interconnection of large power stations. A description of the apparatus used for interconnector control is the content of the ninth chapter; while the last one deals briefly with the principles of the latest development of system control, that is, supervisory control systems.

The material for the book has thus been carefully selected and well arranged, and covers all the important aspects of system design. The information included under each topic is up-to-date. A short bibliography at the end of the book giving references to the more important publications on the subject adds to the value of this monograph.

The printing and get-up of the book are in the usual Chapman style. The few misprints that still persist will, the reviewer hopes, be removed in the next edition.

The book is in short a worthy companion to the preceding ten volumes of the series, and is confidently recommended to the profession.

S. KRISHNASWAMY.

Amaravati Sculptures in the Madras Museum. *Bulletin of the Madras Government Museum* (New Series, General Section, Vol. IV). By C. Sivarama Murthi. Pp. xviii + 376. Price Rs. 14-8-0.

One of the greatest attractions to the Madras Government Museum has been for long its fine Archæological Section. And in that collection, the portion of the Amaravati Sculptures lodged forms the gem. This monograph deals exhaustively yet comprehensively with the whole subject of the unique sculptures that come from near and about Amaravati in

the present Kistna District of the Madras Presidency. Dr. F. H. Gravely, until recently Superintendent of the Madras Government Museum, contributes an appreciative *Foreword*, in which he sets forth in modest terms the many undoubted merits of the work. In view of the fact that he appears to have had much to do with its publication, it seems appropriate that his approval of it should perhaps be referred to at some length. Having regard to limitations of space, however, it cannot more than be adverted to. Mr. Sivarama Murthi has spent much time and labour on his work and as Dr. Gravely rightly observes, has produced something more than a mere catalogue of the sculptures lodged in the Museum. He has brought to bear his knowledge of art on his work also, while his presentation of the history of the Satavahana period lights up certain of its dark corners. He has also enriched our knowledge of social history and manners and habits of the period while the contribution he makes to the problem of the origin of the indigenous form of the Buddha image is indeed suggestive to a degree. It is true a galaxy of stars of the first magnitude in the study of Buddhism have undoubtedly shed light on the subject of these sculptures and their interpretation—such, for instance, by Burgess, Foueber, Coomaraswamy, to mention but a few. What Mr. Sivarama Murthi has done will prove, however, of standing value both as a catalogue and a guide to the sculptures lodged in the Madras Museum and as a study of the architecture, history, culture and art of the period to which they belong. The inscriptions have been re-read and get their right place in the volume. The work, in view of the very solid study it offers of all that is known so far of the Amaravati sculptures in India or in the British Museum is a great contribution historically and linguistically. Mr. Sivarama Murthi deserves to be complimented on his splendid achievement, both as a lover of art and as a scholar anxious to do his bit to advance the study of a subject that has attracted, by virtue of the magnificence of the art with which it is associated such world-wide interest. The monograph, we should add, is illustrated by a number of drawings by the author and enriched by as many as five appendices devoted to relevant special topics. The general Index also deserves mention. This is altogether a volume that is bound to further research in India in many fields than one. As such it is likely to attract wide attention in archæological and art circles the world over, despite the devastating war, in which we are glad it has been found possible to issue it.

C. HAYAVADANA RAO.

SCIENCE NOTES AND NEWS

Treatment of Malaria: A Proved Substitute for Quinine.—In a country like India, where malaria takes such a large toll of life, as well as the energy and efficiency of the population, any shortage in the supply of quinine is naturally viewed with apprehension by the medical profession and public health authorities. Thus, it is good news indeed, to learn that a really effective substitute for quinine is being locally produced and that there is such sufficiency of raw materials as to enable the manufacturers to distribute no less than 14,000,000 tablets this year. The name is Laverain and it is manufactured from quinoidine the non-crystallizable alkaloids of cinchona bark.

Laverain is not new in the treatment of malaria, having been thoroughly tried for a number of years with most effective results. It has the advantages of being somewhat cheaper than quinine and of not producing certain of the undesirable after-effects, notably deafness. Under clinical tests there have been positively no cases of relapse. The news of the manufacture of Laverain on a bulk scale is welcome.

Manure from Town-Wastes.—The training course for Biochemists deputed by different Provinces and States in India in the improved process of preparing compost manure from town-wastes developed at Bangalore, was formally inaugurated at the Indian Institute of Science, Bangalore, on 4th August 1943. It may be recalled that the Government of India recently sanctioned a sum of nearly Rs. 2½ lakhs for a programme of large-scale preparation of compost manure from town-wastes, the scheme to be worked under the auspices of the Imperial Council of Agricultural Research. Dr. C. N. Acharya, Chief Biochemist, is in charge of the training scheme.

"Bubblefil".—A new rayon yarn called "bubblefil" has been developed by E. I. du Pont re Nemours and Company, Wilmington, Del., to replace kapok. According to the *Cordage World* of March 1943, Du Pont is turning out the "bubblefil" cellulose experimentally at the rate of about 200 pounds daily. The new material has buoyant and resilient qualities, making it a potential military substitute for kapok and sponge rubber, the entire supply at present going to the armed services for life rafts, aviators' cushions and possibly other uses.

The supply of kapok has been restricted by the War Production Board to military orders for life buoys, life preservers and jackets, sleeping bags, pontoon bridges, insulation padding for airplanes and a few other specified uses.

New Hydro-Electric Scheme for Madras and Orissa.—Preliminary investigations and surveys for developing hydro-electric power by utilising the Duduna falls of the Machkand river (a tributary of the River Sabari which

in turn empties into the River Godavari) are in progress.

The scheme area is on the boundary line between the Madras and Orissa Provinces, it is located at about 82° 30' N. Lat., and when developed will serve both these provinces.

The area of the basin above the falls is about 860 sq. miles and the mean annual rainfall in the basin is 55 inches. The country is at an altitude above 2,600 M.S.L. and is covered by forest varying in density from thick woods at higher altitudes to scrub jungle in the lower reaches. For the purpose of design in the absence of reliable data the mean annual run off is taken as about 25'.

The natural minimum continuous run off in the stream at the site of scheme is about 100 cusecs and with a storage reservoir of 16,000 Mcft. at Jalaput, seventeen miles higher up the river, continuous power draft of 840 cusecs is possible. The gross head available is about 850' and it lies between contours 2·550' and 1·600' M.S.L. Thus a continuous power of about 48,000 K.W. is possible.

Preliminary estimates show that the scheme is likely to cost about Rs. 2·25 crores and would be remunerative.

The survey and preliminary designs would be finished before 1944 and would be kept ready for execution as soon as the war is over.

The Imperial Institute, London.—Extensive facilities are available at the Imperial Institute, London, for the rapid supply of technical information relating to the trade, occurrence and utilization throughout the world of all kinds of raw materials, but the scope of the intelligence service is not so well known as it should be. The Institute's staff includes tropical agriculturists, chemists, chemical technologists, economic botanists, economic geologists, mining engineers, mineralogists and statisticians, and, when required, the Institute seeks the advice of members of its fifteen consultative committees. Further help is also afforded by numerous trade contacts. The Institute also has an extensive reference library and a technical index covering most of the relevant trade and scientific publications issued during the past thirty years. The Institute can deal with inquiries relating to sources of supply of, and other information relating to, raw materials and semi-manufactured products whether of animal, plant or mineral origin in all countries, cultivation of crops and the soil and conditions under which they have to be grown, methods employed in mining, smelting and dressing minerals for the market, and so on. Analysis and testing of samples of raw materials is undertaken in the laboratories of the Institute. Inquiries should be made in the first instance to the Intelligence Section of the Plant and Animal Products Department or of the Mineral Resources Department, according to the nature of the subject concerned. No charge is made for services to departments of the United Kingdom Government or other Governments of the Empire contributing to the general funds of the Institute unless a particular inquiry involves a volume of work so great that it cannot be undertaken by the existing staff.

The Institute of Chemistry.—*Nature* reports that His Majesty the King has been pleased to command that the Institute of Chemistry shall henceforth be known as "The Royal Institute of Chemistry of Great Britain and Ireland".

Indian Chemical Industries.—"In India, a chemical industry based on petroleum, sugar and calcium carbide might prove to be far more economical than one based upon coal tar. Development on these lines will necessarily involve much fundamental research and may appear to be speculative at the present time, but it seems to be more likely to lead to success than one based on older and well-established methods. It would certainly be profitable for the younger chemists now being trained in India to devote some of their energy and skill to a consideration of these problems. A further large field for research is to be found in the development of India's reserves of cellulose. In Sweden the exigencies of war have emphasised how very valuable a raw material this is. In the post-war years, we may anticipate that India will lead in this and in other fields of technical research."—(*Nature*, 1943, 151, 412.)

Indo-China Cultural Study Scheme.—A Selection Board consisting of Sir Maurice Gwyer, former Chief Justice of India, and Mr. John Sargent, Educational Commissioner with the Government of India, has selected ten Indian students who will proceed to China for research work at Chinese Universities under the Indo-China Cultural Study Scheme. A batch of ten Chinese students is expected in India by the end of this month for a similar object.

Research Schemes.—The Government of Madras have sanctioned the following schemes: Research on Insects Occurring in Stored Oil Seeds (particularly groundnuts), at a cost of Rs. 4,300 for one year (Rs. 3,225 has been granted by the Imperial Council of Agricultural Research); Research on Pests and Diseases of Groundnuts, costing Rs. 10,907 for two years (the Imperial Council's contribution being Rs. 8,181); and Research on the Storage of Groundnuts, at a cost of Rs. 1,24,040 for three years (the Imperial Council's contribution being Rs. 62,000).

Seven Lakhs for Research.—At a recent meeting of the Bombay University Senate it was announced that Sir Homi Mehta had donated Rs. 7 lakhs to the University to be utilised for research in chemistry in connection with the Technological Department of the University.

Nagpur University.—Sir Mirza M. Ismail, Prime Minister of Jaipur, in the course of his Convocation Address to the University of Nagpur, said: "With victory and peace will come a new era for our country, an era of perfect freedom, with such industrial opportunity as she has never known before. The graduates of to-day will spend their lives in a totally new world with social, economic and political problems of a complexity corresponding to their

richness in opportunity. It is for our university men to solve these problems, in patient thought, and in really unselfish and patriotic world.

"This country can become one of the most powerful and influential in the world, if only she uses her resources and energies aright. I think the great danger is that we may spend much of our force in conflict with each other. Whatever form our free Constitution is to take, we—especially we who have, in a university, been trained in a certain self-discipline of thought, feeling and behaviour—should, undoubtedly, be leaders in moderation, mutual understanding, and respect, and in a new and practical policy of political and social compromise."

Industrialisation of Travancore.—Sir C. P. Ramaswami Ayyar, the Dewan, presiding at the session of the Sri Chitra Council, dwelt on the major activities of the nation-building departments. Under industries, he described the immense potentialities of the ship-building industry. The Government had under consideration the development of coastal shipping, and had enlisted the assistance of all-India export businessmen actually engaged in coastal shipping service. Part of the scheme was to co-ordinate back-water traffic with the coastal service. This led to the need to develop a ship-building industry. He then mentioned other major industries largely connected with the production of food and clothing, specially the chemical and fertiliser industries. He drew attention to the natural advantages the country possessed by way of raw materials and the by-products of existing industries. A heavy chemical industry would soon be started.

MAGNETIC NOTES

Magnetic conditions during July 1943 were slightly more disturbed than in the previous month. There were 8 *quiet* days and 23 days of *slight* disturbance as against 14 quiet days, 16 days of slight disturbance and one of moderate disturbance during July of last year.

The quietest day during July 1943 was the 14th and the day of largest disturbance was the 5th.

The individual days during the month were classified as shown below:—

Quiet days	Disturbed days
	Slight
1, 2, 14, 20, 23, 24, 28, 29	3–13, 15–19, 21, 22, 25–27, 30, 31

No magnetic storm occurred during the month of July in the years 1942 and 1943.

The mean character figure for the month of July 1943 was 0·74 as against 0·58 for July of last year.

M. V. SIVARAMAKRISHNAN.

SEISMOLOGICAL NOTES

Among the earthquake shocks recorded by the seismographs in the Colaba Observatory, Bombay, during the month of July 1943, there were two of moderate and one of slight intensities. The details for those shocks are given in the following table:—

Date	Intensity of shock	Time of origin (I.S.T.)	Epicentral distance from Bombay	Co-ordinates of epicentre (tentative)	Depth of focus
		H. M.	(Miles)		(Miles)
15	Slight	18 22	1840		
23	Moderate	21 23	3200	Lat. 7°·5 S., Long. 113°E., near Java.	60
29	Moderate	09 32	8660		

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 91, Nos. 4637, 4638 and 4640.

"Journal of Agricultural Research," Vol. 66, No. 4.

"Agricultural Gazette of New South Wales," Vol. 54, Pt. 5.

"Indian Journal of Agricultural Science," Vol. 13, Pt. 2.

"Biological Reviews," Vol. 18, No. 2.

"Journal of the Indian Botanical Society," Vol. 22, Nos. 2, 3 and 4.

"Journal of the Indian Chemical Society," Vol. 20, No. 6.

"Journal of Chemical Physics," Vol. 11, Nos. 3-4.

"Chemical Products and Chemical News," Vol. 6, Nos. 5-6.

"Indian Farming," Vol. 4, No. 4.

"Transactions of the Faraday Society," Vol. 39, Pt. 6.

BOOKS

An Introduction to Pure Solid Geometry. By G. S. Mahajani. (Mr. Vithal Hari Barve, Aryabhushan Press, Poona), 1943. Pp. iii + 104. Price Rs. 3.

The Cathode Ray Oscillograph in Industry. By W. Wilson. (Chapman and Hall, Ltd., London), 1943. Pp. xii + 150. Price 12*sh.* 6*d.*

Spectrophotometry in Medicine. By Ludwig Heilmeyer. (Adam Hilger Ltd., London), 1943. Pp. xiv + 280. Price 30*sh.*, postage 9*d.*

Electrical Precipitation of Flue Dust in Power Stations. (Technical Report Reference Z/T55). By D. V. Onslow. (The British Electrical and Allied Industries Research Association, London), 1941. Pp. 27. Price 1*s.*

Proposed Purchasing Specifications for Pure Lac for Electrical Insulating Purposes (Technical Report No. A/S49). (The British Electrical and Allied Industries Research Association, London), 1938. Pp. 14 + 2. Price 1/6*d.*

An Introduction to Historical Plant Geography. By E. V. Wulff. (Waltham, Mass: The Chronica Botanica Co.; Calcutta: Macmillan & Co., Ltd.), 1942. Pp. xv + 223. Price $4.75.

785-43—Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for The Current Science Association, Bangalore